

## CLAIMS

1. An engine starting control system of an internal combustion engine including: a plurality of cylinders, each of which has an intake passage injection valve for  
5 injecting fuel into an intake passage, a cylinder injection valve for injecting fuel into a cylinder, and an ignition plug for igniting an air-fuel mixture in a cylinder; and engine stopping means for performing an engine stop of the internal combustion engine when a predetermined condition is satisfied in an operating state of the internal combustion engine, the system comprising:

10 combustion stroke prediction means for predicting a combustion stroke that a cylinder of said internal combustion engine reaches when said internal combustion engine comes to an engine stopped state by said engine stopping means;

preliminary fuel injection means for injecting fuel of a predetermined amount from said intake passage injection valve into the intake passage just before said internal  
15 combustion engine comes to an engine stopped state, in an expansion stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction means is an expansion stroke; and

engine starting means for performing, in said expansion stroke cylinder, an engine start of the internal combustion engine in an engine stopped state by injecting fuel  
20 from said cylinder injection valve into the cylinder and igniting an air-fuel mixture in the cylinder by said ignition plug.

2. The engine starting control system of the internal combustion engine according to claim 1, wherein a fuel amount injected from said cylinder injection valve  
25 by said engine starting means is such an amount that said predetermined amount is subtracted from a total amount of engine starting fuel required for an engine start in said expansion stroke cylinder.

3. The engine starting control system of the internal combustion engine according to claim 1 or 2, wherein

said preliminary fuel injection means further injects fuel of a predetermined injection amount for a compression stroke cylinder from said intake passage injection valve into the intake passage just before said internal combustion engine comes to an engine stopped state in a compression stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction means is a compression stroke, and

said engine starting means further performs, in said compression stroke cylinder, an engine start by injecting fuel from said cylinder injection valve into the cylinder, and igniting an air-fuel mixture in the cylinder by said ignition plug subsequent to said expansion stroke cylinder.

4. An engine starting control system of an internal combustion engine including: a plurality of cylinders, each of which has an intake passage injection valve for injecting fuel into an intake passage, a cylinder injection valve for injecting fuel into a cylinder, and an ignition plug for igniting an air-fuel mixture in a cylinder; and engine stopping means for performing an engine stop of the internal combustion engine when a predetermined condition is satisfied in an operating state of the internal combustion engine, the system comprising:

combustion stroke prediction means for predicting a combustion stroke that a cylinder of said internal combustion engine reaches when said internal combustion engine comes to an engine stopped state by said engine stopping means;

preliminary fuel injection means for injecting fuel of a predetermined amount for a compression stroke cylinder from said intake passage injection valve into the intake passage just before said internal combustion engine comes to an engine stopped state, in the compression stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction means is a compression stroke; and

engine starting means for performing an engine start of the internal combustion

engine in an engine stopped state by, in an expansion stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction means is an expansion stroke, injecting fuel from said cylinder injection valve and igniting an air-fuel mixture in the cylinder by said ignition plug, and then in said compression stroke cylinder, igniting an air-fuel mixture in the cylinder by said ignition plug.

5. An engine starting control system of an internal combustion engine including: a plurality of cylinders, each of which has an intake passage injection valve for injecting fuel into an intake passage, a cylinder injection valve for injecting fuel into a cylinder, and an ignition plug for igniting an air-fuel mixture in a cylinder; and an engine stopping unit to perform an engine stop of the internal combustion engine when a predetermined condition is satisfied in an operating state of the internal combustion engine, the system comprising:

a combustion stroke prediction unit to predict a combustion stroke that a cylinder of said internal combustion engine reaches when said internal combustion engine comes to an engine stopped state by said engine stopping unit;

a preliminary fuel injection unit to inject fuel of a predetermined amount from said intake passage injection valve into the intake passage just before said internal combustion engine comes to an engine stopped state, in an expansion stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction unit is an expansion stroke; and

an engine starting unit to perform, in said expansion stroke cylinder, an engine start of the internal combustion engine in an engine stopped state by injecting fuel from said cylinder injection valve into the cylinder and igniting an air-fuel mixture in the cylinder by said ignition plug.

6. The engine starting control system of the internal combustion engine according to claim 5, wherein a fuel amount injected from said cylinder injection valve

by said engine starting unit is such an amount that said predetermined amount is subtracted from a total amount of engine starting fuel required for an engine start in said expansion stroke cylinder.

5           7. The engine starting control system of the internal combustion engine according to claim 5 or 6, wherein

          said preliminary fuel injection unit further injects fuel of a predetermined injection amount for a compression stroke cylinder from said intake passage injection valve into the intake passage just before said internal combustion engine comes to an engine stopped state in a compression stroke cylinder in which a combustion stroke  
10           predicted by said combustion stroke prediction unit is a compression stroke, and

          said engine starting unit further performs, in said compression stroke cylinder, an engine start by injecting fuel from said cylinder injection valve into the cylinder, and igniting an air-fuel mixture in the cylinder by said ignition plug subsequent to said  
15           expansion stroke cylinder.

          8. An engine starting control system of an internal combustion engine including: a plurality of cylinders, each of which has an intake passage injection valve for injecting fuel into an intake passage, a cylinder injection valve for injecting fuel into a  
20           cylinder, and an ignition plug for igniting an air-fuel mixture in a cylinder; and an engine stopping unit to perform an engine stop of the internal combustion engine when a predetermined condition is satisfied in an operating state of the internal combustion engine, the system comprising:

          a combustion stroke prediction unit to predict a combustion stroke that a  
25           cylinder of said internal combustion engine reaches when said internal combustion engine comes to an engine stopped state by said engine stopping unit;

          a preliminary fuel injection unit to inject fuel of a predetermined amount for a compression stroke cylinder from said intake passage injection valve into the intake

passage just before said internal combustion engine comes to an engine stopped state, in the compression stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction unit is a compression stroke; and

an engine starting unit to perform an engine start of the internal combustion engine in an engine stopped state by, in an expansion stroke cylinder in which a combustion stroke predicted by said combustion stroke prediction unit is an expansions stroke, injecting fuel from said cylinder injection valve and igniting an air-fuel mixture in the cylinder by said ignition plug, and then in said compression stroke cylinder, igniting an air-fuel mixture in the cylinder by said ignition plug.

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